DOCUMENT RESUME

ED 207 084 CS 206 602

AUTHOR Frith, Uta
TITLE Cognitive Processes in Spelling and Their Relevance to Spelling Reform.
PUB DATE 81
NOTE 13p.; Paper presented at the Annual Meeting of the International Conference on Reading and Spelling (3rd, Edinburgh, Scotland, July 31-August 3, 1981).

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Cognitive Processes; Educational Technology; Elementary Secondary Education; *Epistemology; Phoneme Grapheme Correspondence; Phonics; Reading Processes; *Spelling; *Spelling Instruction; Writing Processes
IDENTIFIERS *Reading Writing Relationship

ABSTRACT

Cognitive psychology has provided an information processing model that distinguishes between input processes such as listening to speech or reading and output processes such as speaking or writing. It is useful for spelling reformers to consider reading (input) and writing (output) processes separately, because the demands of the reader and of the writer are, to a large extent, incompatible. The writer might wish to use a sound-to-letter strategy, possibly an individual shorthand. On the other hand, the reader may find phonetic or shorthand writing very demanding since reading rarely uses a letter-to-sound strategy. Readers tend to rely on a variety of cues present in conventional English orthography. These cues may relate directly (visually rather than phonologically) to the meaning, origin, and syntactic function of words. As seen from this point of view, a purely phonetic spelling reform would favor only the writer and penalize the reader. An ideally efficient communication system for written language would have to allow for the different requirements of the reader and writer. One solution would be a device that could be linked to a keyboard or writing pad and transform input written phonetically or in individual shorthand into output that would appear on screen or in print as widely readable copy and that could be programed to give as much graphic and orthographic information as is desirable. (Author/HOD)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

This document has been reproduced as received from the person or organization originating it.
Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

ED207084

COGNITIVE PROCESSES IN SPELLING AND THEIR RELEVANCE TO SPELLING REFORM

Paper presented at the 3rd International Conference "Spelling, Research and Reform".

Edinburgh, 31st July 1981

by

Uta Frith

MRC Developmental Psychology Unit

Drayton House, Gordon Street

London WC1H OAN

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Uta Frith

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

CS206602

Abstract

Cognitive psychology has opened up some new and interesting ways of thinking about spelling and reading. In the past there have been innumerable studies investigating relationships between all sorts of psychological variables and visible language skills with often disappointing results. In contrast, the cognitive approach does not take any of these "skills" at their face value but attempts to analyse them into components. These components have a place in models that specify operations, strategies and processes suggesting how reading and spelling are acquired, how they function and how they fail.

This analytic approach has demonstrated that reading and writing are related in a complex way and that they both go beyond a letter-sound correspondence principle. It is useful for spelling reformers to consider reading (input) and writing (output) processes separately, in their own right. This is because the demands of the reader and of the writer are to a large extent incompatible. The writer might wish to use a sound-to-letter strategy, possibly an individual shorthand. The reader, on the other hand, finds phonetic or shorthand writing very demanding, since he rarely uses a letter-to-sound strategy. He tends to rely on a variety of cues present in conventional English orthography. These cues may relate directly (visually rather than phonologically), to the meaning, origin and syntactic function of words.

Seen from this point of view, a purely phonetic spelling reform would favour only the writer, but penalize the reader. An ideally efficient communication system for written language would have to allow for the different requirements of the writer and the reader. A no longer Utopian solution would be a device that is linked to a keyboard or writing pad and essentially transforms input written phonetically or in individual shorthand into output which appears on screen or in print as widely readable copy, and which could be programmed to give as much graphic and orthographic information as is desirable.

Cognitive psychology has flourished on a highly effective, yet astonishingly simple model of how we perceive, remember, think and do things. All these are activities that involve cognitive processes, but most of all, cognitive processes are identified with communication skills. Information processing is the key phrase to charactierize this simple model, and it is ideally suited to describe spoken or written language. The model distinguishes between INPUT processes - these could be listening to speech or reading - and OUPUT processes, such as speaking or writing. In between input and output we have traditionally a "black box". Inside we imagine to exist our internal representation of language - and indeed our representation of the world.

This input-output model is also useful in order to consider what we mean by spelling. There are really three subtly, but importantly different meanings of spelling, which are easily confused. If seen in relation to input processes, spelling denotes orthographic structure. We can talk of spelling patterns, letter position, specific graphemic units, etc. It is clear that 6 year old beginning readers are already sensitive to orthographic structure (Henderson and Chard, 1980). Even non-readers, for instance, can distinguish illegally spelled words(prtd) from legally spelled ones (prid). It is easy to observe this by asking them to sort such stimuli into the categories "possibly words" and "definitely not words". If seen in relation to output processes, spelling means word production. In order to be correct, the word has to be correct letter-by-letter. It is this production process that has received least study and that yet gives rise to more problems than other aspects of literacy. Spelling also sometimes means spelling knowledge, which is represented inside the black box, as if in some internal dictionary. How this knowledge is actually acquired and how it is available for use is still largely unknown. An example would be the knowledge we bring to bear in spelling entirely new words by analogy and in detecting errors in our own writing.

If we go along with the model, these three meanings of "spelling" have to be kept apart, as quite different psychological processes are involved in the three functions. Spelling as an INPUT skill has most to do with reading. Spelling as an OUTPUT skill has most to do with writing. The third function of spelling is the least accessible to study and rests largely in inference, while input and output skills can be observed directly. Nevertheless, we cannot do without the assumption that a literate person has a vast store of knowledge about the written form of words. There must be an internalized system of visible language just as there is of spoken language.

One very intriguing question is in what form is this knowledge represented? Is there really something like a collection of specific visual images for every word? That visible language has a "visual" component must be taken for granted. However, this component is abstract-visual, not physical-visual: structures that are not like photographs, but like programmes that specify each letter in its correct position, whatever physical shape the letter may have.

The internal representation of spelling knowledge is not as speculative an assumption as it might appear. That the notion has a psychological reality can perhaps be shown by the existence of spelling riddles in folklore. A number of these have been collected and discussed by Green and Pepicello (1980). They classified spelling riddles into several types, two of which are especially relevant here. The first type is like this: "What's black and white and red/read all over? (a newspaper)". This is concerned with the fact that the same sound can have a different spelling. The sound in context tricks you into thinking of the wrong member of the pair, namely (red) as colour rather than (read) as in reading. The spelling, of course, is completely unambiguous and this allows the joke to work. This type of riddle belongs to the vast class of jokes that are known as puns. One wonders if people with completely phonetic orthographies should not be considered deprived, by missing out on this form of entertainment.

The second type of riddle is as follows: "What tune does everyone like?" (fortune). "What ants are the largest?" (giants). "What age is served at breakfast?" (sausage). This type is concerned with the fact that the same spelling can have different sounds (e.g. tune sounds /tj u:n/ in fortune). What is interesting about this type of riddle is that it really shows that letter strings are known or represented internally without respect to a specific sound. It is the same /t/u/n/e/ if it is pronounced /tj u:n/ or /t ʃen/.

These few examples suffice to show that there is some psychological reality to the notion of internal spelling knowledge and that this knowledge rests on a quite complex system of visible language.

Naturally, cognitive psychologists have elaborated the simple input-output model into highly sophisticated versions and excellent accounts are available (e.g. Cohen, 1977; Morton, 1979; Seymour, 1979). The findings that emerged from experiments based on a cognitive model are very relevant to students of reading and spelling. I believe that they have brought about a significant advance in our understanding of reading and spelling skills (Frith, 1980). The main advance compared to older studies probably rests in the microanalysis of reading and spelling. The black box has in fact begun to be unpacked.

A specific example is the analysis of reading and spelling skills in terms of two relatively independent strategies. We can read a word - to some extent at least - as if it were a Chinese symbol, that is, disregarding any relationships of letters to speech sounds. Hence this strategy has been termed "Chinese". This strategy is very fast, but the problem with it is that every single word needs to have a specific entry in an internal lexicon. If it is a short word, it can be recognized as a whole pattern straight away; if it is a long word, or is inflected, then it needs to be broken down into proper meaningful segments first, each of which are then instantly recognized. The important point is that this is not letter-by-

letter reading, the meaningful segments are groups of letters taken in at once. Furthermore, individual letters are not translated into sound. With this "Chinese" strategy it is therefore quite irrelevant, if the letter-sound correspondences are ambiguous or unpredictable from general rules. We can illustrate this with an example of "Chinese" reading that is familiar to all of us: seeing "12" or "XII" makes us say /twelv/ or /tsvɜ:lf/ or /du:z/ of /dodit∫i:/ etc.

The other and truly alphabetic strategy has been termed "Phoenician". This strategy treats the alphabetic writing system as it was originally intended by its inventors, the Phoenicians. Letter and speech sound are intimately connected, but in such a way that the stream of speech is broken up into small artificial units which are designated phonemes and which are represented by particular graphemes. To use this stragegy, one does not require specific word recognizers: any word can be read - in theory - by pronouncing each letter according to the rules. The problem here for English is that we need to put together the single letters into bigger meaningful units before we can really pronounce them, or to know where to put the stress (Smith, 1980). For the most part this is not the fault of the orthography, but the "fault" of the spoken language itself. Phonemes do change in context. Hence we have problems with, for example, finite-infinite, active-action, courage-courageous. Here the same vowel in the word pairs is pronounced very differently, but spelled the same. This orthographic convention makes transparent the underlying relationship of the words - in spite of the fact that our speech (at present) does not make such a relationship very clear. The examples also serve to illustrate that written language is not merely parasitic on spoken language - rather it makes an independent contribution to communication. Indeed, it may itself affect speech and can be shown in numerous examples even to have changed speech over time (Levitt, 1978).

The two reading strategies, "Chinese" and "Phoenician" are well known to teachers by the labels "Look-and-say" and "Phonics". Both have been applied to reading as well as to spelling, but there is some indication that "Chinese" has more affinity to reading and that "Phoenician" has more affinity to spelling. One reason for saying this is that reading errors are not usually mispronunciations of component sounds, but an error is usually a completely different word that is substituted. It seems that the wrong lexical entry was being activated, rather than that a string of sounds was laboriously and falsely marked out. On the other hand, spelling errors and slips of the pen are very often phonetic, that is, they do seem to be derived by an application of sound-to-letter rules. Marsh et al (1981) compared errors in reading and spelling the same material in three age groups and concluded that the strategies were markedly different.

Even good spellers make spelling errors, usually by accident rather than by ignorance. Interestingly enough, many of their unintentional slips of the pen are in homophonic words, e.g. their for there; to for too, etc. Two aspects of these slips are important: that they are words themselves and that they sound similar to the target word. Since word is substituted by word, probably a confusion between two automatic spelling programmes occurred. Since the correct sound is retained, it appears that the spelling program was retrieved through sound. Morton (1980) suggests that a phonological code could be used as a unit to access the letter-by-letter code for the word. The mental lexicon itself may be organized phonologically (Fay and Cutler, 1977). Thus the direct ("Chinese") or lexical route still may be triggered by a phonological code. However, its role would not be to provide phoneme to grapheme correspondences, only to retrieve an automatic spelling program for a whole word. Why should a sound code rather than a visual code take on this role?

A theory that is relevant to this notion has been proposed by O'Connor and Hermelin (1978). According to their theory, there is an affinity of temporal-sequential processes (which include speaking and spelling) with phonological coding. Thus, while writing, sound is the appropriate code and would override a visual code, and, as in speech, does not distinguish for instance, their from there (Frith and Frith, 1980). In contrast, in reading, a visual code would seem highly appropriate. It is a very fast process, where sound enters at a later stage only. It can readily be imagined that if there was a race between "Chinese" and "Phoenician" word recognition, the Chinese one would win. On the other hand, in writing, this speed is not necessarily an advantage as the writing process itself is slow enough for a sound code to catch up easily.

Evidence for the separation of reading and writing strategies is also available from another source. In young children just beginning to learn to read and write, Bryant and Bradley (1970) observed that they would read words they could not write and write words they could not read. This odd discrepancy was explained by the fact that the children spontaneously preferred to read the words by Look-and-say, but to write them by Phonics. The important observation that young preschool children may take quite readily to writing, given basic knowledge of letter names and sounds, was analysed by Charles Read (1971). He also found that often such precocious children could not read what they themselves had written. To decode sound to letter seemed more "natural" than to decode letter to sound.

Discrepancies between reading and writing should not come as a surprise. Indeed, they are expected in terms of an information processing model, since input and output are not just the same process in reverse, butare in fact quite independent of each other. Using a computer analogy, the information typed in at the keyboard terminal bears only a superficial relationship to what appears on the print-out. The information that is typed in can be, but need not be, converted into signals that activate a printer. The speeds

of the various operations involved also are independent of each other. The printing time is presumably limited by mechanical conditions specific to the printer. Similarly, writing or typing by hand cannot be faster than the motor system allows.

This notion of independence of input and output has important implications for teaching and for changing spelling. It implies that learning to read does not at the same time necessarily lead to learning to spell. Furthermore, as already mentioned, input and output processes seem to have specific preferences for particular codes. For example, a lexical recognition system might rely on a "visual" code, a sound-letter translation system may well rely on a sound-based code. A sound-based code, as O'Connor and Hermelin have suggested, is essentially a sequential code, a visual code on the other hand is a spatial code that is not dependent on temporal sequence. In reading, we can imagine that a spatial code is efficient. In spelling a sequential code might be especially advantageous, as it goes along with sequential programmes.

All this supports the idea that the requirements for input (reading) and for output (writing) processes are not only independent, but in some sense incompatible. It seems as if the Phoenician invention of the alphabet tailor-made for writing, while the Chinese system is tailor-made for reading.

One particular difference regards flexibility and rigidity of the processes. It seems to me that flexibility is desirable where processing of input is concerned, simply because the form of the input can vary so much. Material to be read does come in many different forms: prints vary, even given perfect legibility, but legibility also varies, depending on the conditions of, e.g. light, distance, state of the material, etc. The idiosyncracies of the sender of the communication may have to be taken into account, his handwriting and his spelling ability. It pays, therefore, for an input processing system to be flexible and adjustable to the situational demands. This is the opposite of having a pre-programmed system, where we would utterly depend on input

material being reliably the same in every case. I would like to suggest that this sort of system is not viable for reading, but is very well suited for an output process, such as writing.

For output processes to function efficiently, pre-programming is needed. This requires a fixed sequence of actions. Preprogramming is evident in handwriting - which is characteristic for each individual. There may be a number of quite long automatic sequences for frequent words and frequent word-components. Studies are in progress that look at the exact timing of writing movements in order to discover the size of basic units as well as longer spelling programs. It is important, however, to realize that spelling programs do not reside in the actual writing movements. This would be absurd, since we can spell equally well if we type, or print, or write with our non-preferred hand, or spell orally. The spelling program underlies the motor program, but is not identical with it. It is true that we still know little about the nature of the output programmes, and we also know very little about the input programmes, but experimentation is following along quite promising paths. It is clear that what appears to be a superficially simple relationship of spelling and reading processes is in fact not at all simple.

What conclusions can we draw at this point that might have some bearing on spelling reform issues? It seems to me that any reform that is guided by a single principle, if it is an advantage to one process, it is bound to be a disadvantage to the other. A single principle cannot satisfy both processes. If we take the principle of unambiguous letter-sound correspondence, it may well be that spelling would benefit by a simplified sound-based system, but, inevitably, reading would suffer. Fluent reading is not primarily a sound-based process, but much more a visual one and could be simultaneous rather than sequential. Writing must always be sequential, in contrast.

In recognizing words we can actually benefit from an orthographic system such as the present one where information is presented at many different linguistic levels. There is a lot of redundancy in the conventional spelling of many words, which enables us, if we wish, to learn about, e.g. the word's language

origin, the word's prior pronunciation, the word's form class, or its relationship to other words. Visible language, as I have already pointed out, is not just a derivative version or imperfect reflection of spoken language. Language is more than speech and has many more aspects than sound. Although there is slow but continuous change in both domains of written and spoken language, it is not clear who or what exactly controls the change. If we knew we would presumably be on the way towards an optimal orthographic system. Clearly, as an experimental psychologist, I would prefer to understand the psychological processes underlying reading and spelling, before trying to change them. Nevertheless, I would like to make a suggestion that is based on the study of cognitive processes. This study taught us that the ideal orthography is different if seen from the point of view of the reader, and the writer. Instead of trying to achieve a compromise - which I believe is actually the continuous state of English orthography - we might look for a radical alternative with help from computer technology. All we need is a translator device (our "black box") that mediates between the ideally efficient sender and the receiver of the written message. The sender, if he likes the Phoenician style, could write in his own preferred phonetic system, possibly in shorthand. The reader (if he likes the Chinese style) could read the message in as non-phonetic and as redundant a way as he liked. The "black box" would have stored all necessary spelling programs. As recent work by Colin Brooks and Robert Baker presented at this concerence shows, such a solution is not as Utopian as it sounds. What makes this technological solution especially exciting to me is that is seems backed by theory and results from cognitive studies in spelling. I hope therefore that it can cut through the tangled controversy on pros and cons of spelling reform and provide a new alternative of communicating in visible language.

References

Bryant, P.E. & Bradley, L. (1980). Why children sometimes write words which they do not read. In Frith, U. (Ed.) Cognitive Processes in Spelling, London: Academic Press

Cohen, G. (1977). The Psychology of Cognition, London: Academic Press

Fay, D. & Cutler, A. (1977). Malapropisms and the structure of the mental lexicon. Linguistic Inquiry, 8, 505-520

Frith, U. (Ed.) (1980). Cognitive Processes in Spelling, London: Academic Press

Frith, U. & Frith, C.D. (1980). Relationship between reading and spelling. In Kavanagh, J.F. and Venezky, R.L. (Eds.), Orthography, Reading and Dyslexia, Baltimore: University Park Press

Green, T.A. & Pepicello, W.J. (1980). Digest of spelling riddles. Journal of American Folklore, 93, 23-34

Levitt, J. (1978). The influence of orthography on phonology: a comparative study (English, French, Spanish, Italian, German). Linguistics, 208, 43-67

Marsh, G., Friedman, M., Desberg, P. & Saterdahl, K. (1981). Comparison of reading and spelling strategies in normal and reading disabled children. In Friedman, M., Das, J.P. and O'Connor, N. (Eds.). Intelligence and Learning, New York: Plenum

Morton, J. (1979). Word recognition. In Morton J. and Marshall, J.C. (Eds.) Psycholinguistics, Series II. London:

Morton, J. (1980). The logogen model and orthographic structure. In Frith, U. (Ed.), Cognitive Processes in Spelling, London: Academic Press

O'Connor, N. & Hermelin, B. (1978). Seeing and Hearing and Space and Time. London: Academic Press

Read, C. (1971). Preschool children's knowledge of English phonology. Harvard Educational Review, 41, 1-34

Seymour, P.H.K. (1979). Human Visual Cognition. London: Collier Macmillan

Smith, P.T. (1980). Linguistic information in spelling. In Frith, U. (Ed.) Cognitive Processes in Spelling, London: Academic Press

Henderson, L. & Chard, J. (1980). The reader's implicit knowledge of orthographic structure. In Frith, U. (Ed.) Cognitive Processes in Spelling London: Acad. Press